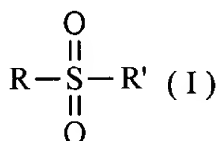


8. (New) The electrolyte for a lithium secondary battery according to claim 6, wherein the sulfone based organic compound is vinyl sulfone.

9. (New) A lithium secondary battery comprising:
an electrolyte comprising a non-aqueous organic solvent and a sulfone based organic compound represented by the following Formula (I):



where R and R' are independently selected from the group consisting of alkenyl groups and halogen substituted alkenyl groups;

a positive electrode including lithium-transition metal oxides as a positive active material; and
a negative electrode including carbon, carbon composite, lithium metal, or lithium alloy as a negative active material.

REMARKS

Claims 1 to 9, as amended, are pending. Applicants have amended claims 1, 2, 4 and 5 and added new claims 6 to 9. Attached hereto is a marked-up version of the changes made to the above-identified application by the current amendment, which is captioned "**Version with markings to show changes made.**" The amendments find full support in the original specification, claims and drawings. Specifically, support for the recitation in claims 1 and 5 that the amount of the sulfone based organic compound is from 1 to 5 weight% can be found in Examples 1 to 10 described at pages 11 and 12 of the specification. No new matter is presented.

Incorporation by Reference

The Examiner objected to the incorporation by reference to two Korean patent applications, contending that the incorporation of essential material by reference to a foreign application is improper.

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However, nonessential subject matter may be incorporated by reference to a foreign patent application. See M.P.E.P. § 608.01(p). Applicants are not relying on the incorporation by reference to the two Korean patent applications for essential material. Accordingly, Applicants submit that the incorporation by reference is proper and request that the objection to the specification be withdrawn.

Claim Objections

The Examiner objected to claims 1 and 5 for reciting improper Markush language. Applicants have amended claims 1 and 5 to obviate this objection and request that it be withdrawn.

Rejection Under 35 U.S.C. § 112, Second Paragraph

The Examiner rejected claims 1 to 5 under 35 U.S.C. § 112, second paragraph, as allegedly indefinite. Specifically, the Examiner stated that it is unclear how the groups are substituted. Applicants have amended claims 1 and 5 to clarify that the groups are halogen substituted groups. Additionally, the Examiner objected to the Markush group language for R and R', which Applicants have amended. Finally, the Examiner objected to the weight% limitation in claim 4 because the basis for the percentage is unclear. Applicants have amended claim 4 to clarify the basis for the percentage, as set forth in the specification at page 8, line 17, to page 9, line 1. Applicants' amendments have obviated the rejection under section 112, second paragraph, and Applicants request that the rejection be withdrawn.

Rejections Under 35 U.S.C. § 102(b)

Marple - U.S. Patent No. 5,290,414

The Examiner rejected claims 1 and 3 to 5 under 35 U.S.C. § 102(b) as allegedly unpatentable over Marple (U.S. Patent No. 5,290,414). Applicants respectfully traverse this rejection.

Independent claims 1 and 5 have been amended to recite that the amount of the sulfone based organic compound is from 1 to 5 weight%. As implicitly acknowledged by the Examiner in not rejecting original claim 4 (which recites that the amount of the sulfone based organic compound is from 0.1 to

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10 weight%) over Marple, Marple does not teach or suggest the claimed amount of the sulfone based organic compound.

Additionally, Applicants have added new independent claims 6 and 9 that recite that the sulfone based organic compound is a compound of Formula (I) where R and R' are independently selected from alkenyl groups and halogen substituted alkenyl groups. Marple teaches an electrolyte containing tetramethylene sulfone, but does not teach or suggest an electrolyte containing a sulfone based organic compound as recited in claim 6 or 9.

Accordingly, Applicants request that the rejection under section 102(b) over Marple be withdrawn.

JP 5-307974A

The Examiner rejected claims 1, 3 and 5 under 35 U.S.C. § 102(b) as allegedly anticipated by JP 5-307974A. Applicants respectfully traverse this rejection.

As noted above, independent claims 1 and 5 have been amended to recite that the amount of the sulfone based organic compound is from 1 to 5 weight%. As implicitly acknowledged by the Examiner in not rejecting original claim 4 over JP 5-307974A, JP 5-307974A does not teach or suggest the claimed amount of the sulfone based organic compound.

Additionally, Applicants have added new independent claims 6 and 9 that recite that the sulfone based organic compound is a compound of Formula (I) where R and R' are independently selected from alkenyl groups and halogen substituted alkenyl groups. JP 5-307974A teaches an electrolyte containing sulfolane, but does not teach or suggest an electrolyte containing a sulfone based organic compound as recited in claim 6 or 9.

Accordingly, Applicants request that the rejection under section 102(b) over JP 5-307974A be withdrawn.

Gernov - U.S. Patent No. 6,194,099

The Examiner rejected claims 1, 3 and 4 under 35 U.S.C. § 102(e) as allegedly anticipated by Gernov et al. (U.S. Patent No. 6,194,099). Applicants respectfully traverse this rejection.

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The Examiner states that Gernov describes an exemplary electrolyte comprising 9.7 wt% sulfolane based on the weight of the electrolyte. However, Gernov does not teach or suggest an electrolyte containing 1 to 5 wt% of a sulfone based organic compound as recited in independent claims 1 and 5. Nor does Gernov teach or suggest an electrolyte containing a sulfone based organic compound of Formula (I) where R and R' are independently selected from alkenyl groups and halogen substituted alkenyl groups, as recited in new independent claims 6 and 9. Accordingly, Applicants respectfully request that the rejection under section 102(e) over Gernov be withdrawn.

Angell et al. - U.S. Patent No. 6,245,465

The Examiner rejected claims 1, 2 and 5 under 35 U.S.C. § 102(e) as allegedly anticipated by Angell et al. (U.S. Patent No. 6,245,465). Applicants respectfully traverse this rejection.

As implicitly acknowledged by the Examiner in not rejecting original claim 4 over Angell, Angell does not teach or suggest that the sulfone based organic compound is present in an amount from 1 to 5 weight%, as recited in amended independent claims 1 and 5. Further, Angell does not teach or suggest an electrolyte containing a sulfone based organic compound of Formula (I) where R and R' are independently selected from alkenyl groups and halogen substituted alkenyl groups, as recited in new independent claims 6 and 9. Accordingly, Applicants respectfully request that the rejection under section 102(e) over Angell be withdrawn.

WO 99/16144

The Examiner rejected claims 1 to 5 under 35 U.S.C. § 102(b) as allegedly anticipated by WO 99/16144, with the European counterpart EP1030399 A1 being relied on for a translation of WO 99/16144. Applicants respectfully traverse this rejection.

Independent claims 1 and 5 recite that the amount of the sulfone based organic compound is from 1 to 5 weight%. EP1030399 discloses that the amount of the sulfone based organic compound is preferably from 0.1 to 15 vol% (see page 5, lines 29 to 31), but can range from 0.05 to 100 vol% (see page 5, lines 10 to 11). The only other teachings of amounts of sulfone compounds in EP1030399 are in Examples 11 and 12. Specifically, Example 11 describes an electrolyte containing 50 vol% sulfolane,

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and Example 12 describes an electrolyte containing 10 vol% sulfolene, neither of which falls within Applicants' claimed range.

Although the ranges recited in EP1030399 encompasses the claimed range, they do not touch, overlap or fall within the claimed range. In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with sufficient specificity to constitute an anticipation. See M.P.E.P. § 2131.03, which addresses anticipation of ranges. This section provides that if the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed range, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims. The unexpected results may also render the claims unobvious.

Applicants submit herewith evidence of unexpectedly superior results that were achieved with the claimed invention in the form of a declaration by Jin-sung Kim pursuant to 37 C.F.R. § 1.132. As explained in the declaration, Mr. Kim prepared several lithium batteries containing electrolytes comprising a sulfone based organic compound according to the invention in varying amounts that fall within the claimed range and outside the claimed range. The rates of increase in the thicknesses of the batteries were measured, and the rates of increase are set forth in Table 1 of the declaration. As can be seen from Table 1, the batteries containing an electrolyte with a sulfone based organic compound in an amount of 1 wt%, 2 wt% and 5 wt% showed significantly less variation in thickness after charging compared to batteries containing an electrolyte with a sulfone based organic compound in an amount of 0.005 wt%, 0.05 wt% and 10 wt%. As testified to by Mr. Kim, an expert in the field of electrolytes for lithium batteries, this significant difference was unexpected.

Further, the cycle life characteristics of batteries containing sulfone based organic compounds in varying amounts were measured. As shown in Figures 1 and 2 of Mr. Kim's declaration, batteries containing electrolytes with sulfone based organic compounds in an amount of 1, 2 or 5 wt% had substantially improved cycle life characteristics compared to batteries containing electrolytes with the same sulfone based organic compounds in an amount of 10 wt%. As testified to by Mr. Kim, the substantially improved cycle life characteristics achieved by the invention were unexpected.

Thus, Applicants have established that the use of a sulfone based organic compound in an amount of 1 to 5 wt% produces unexpectedly superior results compared to the use of a sulfone based

organic compound in an amount above or below this range. Applicants' evidence of unexpected results overcomes any *prima facie* case of obviousness that the Examiner may be able establish based on WO 99/16144 or any of the other cited references.

Further, new independent claims 6 and 9 recite that the sulfone based organic compound is a compound of Formula (I) where R and R' are independently selected from alkenyl groups and halogen substituted alkenyl groups. EP1030399 teaches a compound like that of Formula (I) (see formula 3 at page 3, line 20), where the R groups represent an alkyl group or an aryl group (see page 3, lines 10 to 12). However, EP1030399 nowhere teaches or suggests that the R groups can be an alkenyl group or a halogen substituted alkenyl group. Thus, WO 99/16144 does not anticipate new independent claims 6 and 9.

Accordingly, Applicants respectfully request that the rejection over WO 99/16144 be withdrawn.

Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that pending claims 1 to 9, as amended, are in condition for allowance, and a timely indication of allowance is respectfully requested. If there are any remaining issues that can be addressed by telephone, Applicants invite the Examiner to contact the undersigned at the number indicated below.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By 

Kathleen M. Olster
Reg. No. 42,052
626/795-9900

KMO/edb

Please amend claims 1, 2, 4 and 5 as follows:

- $$\begin{array}{ccc} \text{R}-\text{S}(\text{O})_2-\text{R}' & \text{---} & \text{---} \\ \text{(I)} & & \text{(II)} \end{array}$$

2. (Amended) The electrolyte for a lithium secondary battery according to claim 1, wherein the ~~[substituent is]~~ halogen is selected from the group consisting of fluoro, chloro, bromo, and iodo.

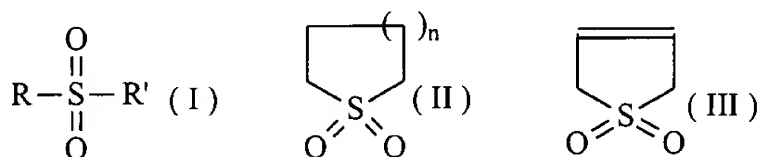
- 10-

5. (Amended) A lithium secondary battery comprising:

an electrolyte comprising a non-aqueous organic solvent and a sulfone based organic compound selected from the group consisting of ~~[a compound]~~ compounds represented ~~[as in]~~ by the following Formulae (I), (II), ~~[or]~~ and (III), and ~~[a mixture]~~ mixtures thereof;

a positive electrode including lithium-transition metal oxides as a positive active material; and

a negative electrode including carbon, carbon composite, lithium metal, or lithium alloy as a negative active material:



where R and R' are independently selected from the group consisting of ~~[a]~~ primary alkyl groups, secondary alkyl groups, ~~[or]~~ tertiary alkyl [group] groups, alkenyl [group] groups, ~~[and]~~ aryl [group] groups, ~~[and a]~~ halogen substituted primary alkyl groups, halogen substituted secondary alkyl groups, ~~[or]~~ halogen substituted tertiary alkyl [group] groups, halogen substituted alkenyl [group] groups, and halogen substituted aryl [group] groups, and n is from 0 to 3, wherein the amount of the sulfone based organic compound is from 1 to 5 weight% based on the total amount of the electrolyte.